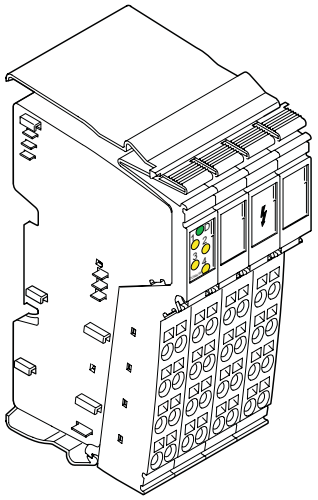
IB IL 24/230 DOR 4/W ...

Inline Terminal With Four SPDT Relay Contacts



AUTOMATIONWORX

Data Sheet
6326_en_02

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Description

The terminal is designed for use within an Inline station.
It has four floating SPDT relay contacts.

The terminal can be used in the SELV area and in the AC area. Observe the appropriate regulations and safety notes when using the terminal in the AC area.

Features

- Safe isolation according to EN 50178
- Floating connection for four actuators
- Nominal current at the output: 3 A
- Total current of the terminal: 4 x 3 A = 12 A
- Diagnostic and status indicators

This data sheet is only valid in association with the IL SYS INST UM E user manual or the Inline system manual for your bus system (see "Documentation" on page 2).

Make sure you always use the latest documentation.
It can be downloaded at www.download.phoenixcontact.com.
A conversion table is available on the Internet at
www.download.phoenixcontact.com/general/7000_en_00.pdf.

This data sheet is valid for all products listed on the following page:

Ordering Data

Products

Description	Type	Order No.	Pcs./Pck.
Inline terminal with four digital relay outputs; complete with accessories (connectors and labeling fields); transmission speed of 500 kbps	IB IL 24/230 DOR 4/W-PAC	2861878	1
Inline terminal with four digital relay outputs; complete with accessories (connectors and labeling fields); transmission speed of 2 Mbps	IB IL 24/230 DOR 4/W-2MBD-PAC	2862039	1
Inline terminal with four digital relay outputs; without accessories; transmission speed of 500 kbps	IB IL 24/230 DOR 4/W	2836421	1
Inline terminal with four digital relay outputs; without accessories; transmission speed of 2 Mbps	IB IL 24/230 DOR 4/W-2MBD	2855541	1

Four connectors are needed for the complete fitting of the IB IL 24/230 DOR 4/W or IB IL 24/230 DOR 4/W-2MBD terminal.

Accessories

Description	Type	Order No.	Pcs./Pck.
Connector for digital single-channel, two-channel or 8-channel Inline terminals with AC voltage (gray, without color print)	IB IL SCN-8-AC-REL	2740290	10
Inline distance terminal; complete with accessories (connectors and labeling fields)	IB IL DOR LV-SET-PAC	2861645	1 set (2 pcs.)

Documentation

Description	Type	Order No.	Pcs./Pck.
"Automation Terminals of the Inline Product Range" user manual	IL SYS INST UM E	2698737	1
"Configuring and Installing the INTERBUS Inline Product Range" user manual	IB IL SYS PRO UM E	2743048	1

Technical Data

General Data	
Housing dimensions (width x height x depth)	48.8 mm x 120 mm x 71.5 mm
Weight	153 g (with connectors), 138 g (without connectors)
Operating mode	Process data mode with 4 bits
Connection method for actuators	At a floating SPDT relay contact
Ambient temperature (operation)	-25°C to +55°C
Ambient temperature (storage/transport)	-25°C to +85°C
Permissible humidity (operation/storage/transport)	10% to 95%, according to DIN EN 61131-2
Permissible air pressure (operation)	80 kPa to 106 kPa (up to 2000 m above sea level)
Permissible air pressure (storage/transport)	70 kPa to 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20 according to IEC 60529
Connection data for Inline connectors	
Connection method	Spring-cage terminals
Conductor cross section	0.2 mm^2 to 1.5 mm^2 (solid or stranded), 24 - 16 AWG

Mechanical Requirements (Deviation From the Inline Specifications)	
Vibration test Sinusoidal vibrations according to IEC 60068-2-6; EN 60068-2-6	2g load, 2 hours in each space direction
Shock test according to IEC 60068-2-27; EN 60068-2-27	2g load for 11 ms, half sinusoidal wave, three shocks in each space direction and orientation

Interface	
Local bus	Through data routing

Transmission Speed	
IB IL 24/230 DOR 4/W, IB IL 24/230 DOR 4/W-PAC	500 kbps
IB IL 24/230 DOR 4/W-2MBD, IB IL 24/230 DOR 4/W-2MBD-PAC	2 Mbps

Power Consumption	500 kbps	2 Mbps
Communications power	7.5 V DC	7.5 V DC
Current consumption at U_L off/on	22 mA/187 mA	45 mA/220 mA
Power consumption at U_L	0.17 W/1.4 W	0.34 W/1.65 W

Supply of the Module Electronics and I/O Through Bus Coupler/Power Terminal	
Connection method	Through potential routing

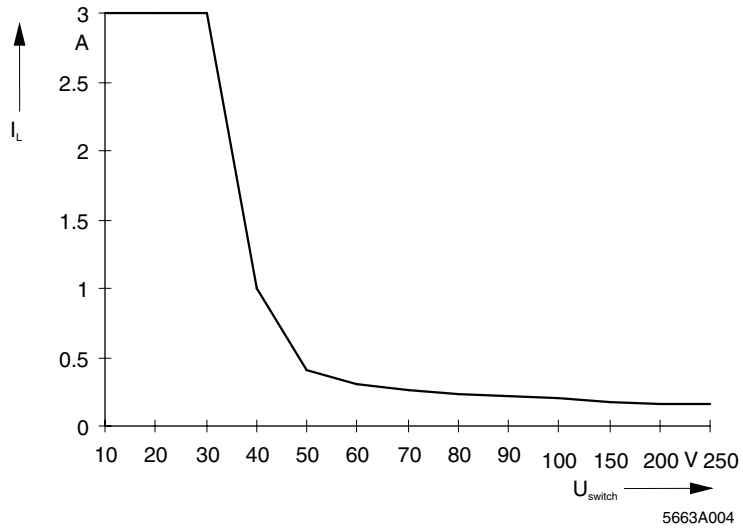
Relay Output	
Number	4
Contact material	$AgSnO_2$, hard gold-plated
Contact resistance	50 mΩ at 100 mA/6 V
Limiting continuous current (at maximum ambient temperature)	3 A
Maximum switching voltage	253 V AC, 250 V DC
Maximum switching power (AC/DC)	750 VA (see derating)
Minimum load	5 V; 10 mA
Switching current at 30 V DC	3 A
Switching current 250 V DC	0.15 A
Maximum inrush current peak for lamp loads and capacitive loads	6 A for T = 200 µs

See also Table "Maximum Switching Current for Ohmic Load Depending on the Switching Voltage (With DC Voltage)" on page 4.

Nominal power consumption of the coil (at 20°C)	330 mW from the 7.5 V supply
Resistance of the coil (at 20°C)	119 Ω ±12 Ω
Maximum switching frequency (without load)	1200 cycles/minute
Maximum switching frequency (with nominal load)	6 cycles/minute
Response delay	5 ms, typical
Bouncing time	5 ms, typical
Release time	6 ms, typical
Mechanical service life	2×10^7 cycles
Electrical service life	10^5 cycles (at 20 cycles/minute)
Common potentials	All contacts floating

Maximum Switching Current for Ohmic Load Depending on the Switching Voltage (With DC Voltage)	
Switching Voltage (V DC)	**Switching Current (A)**
10	3.0
20	3.0
30	3.0
40	1.0
50	0.4
60	0.3
70	0.26
80	0.23
90	0.215
100	0.2
150	0.18
200	0.165
250	0.155

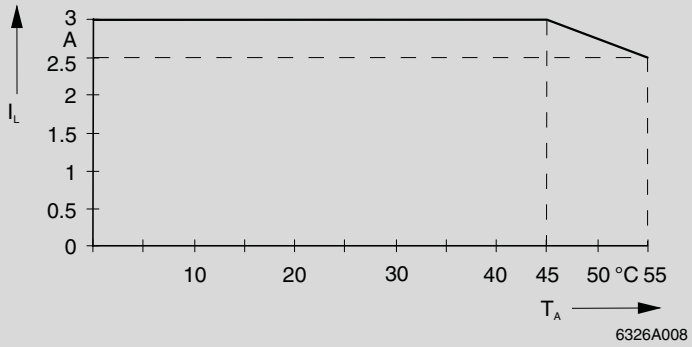
Load Current (I_L in A) as a Function of the Switching Voltage (U_{switch} in V)



Maximum Switching Current Depending on the Temperature (With AC Voltage)

With a switching current of 3 A, AC switching voltages must not exceed 253 V AC. Observe the derating.

Load Current (I_L in A) as a Function of the Ambient Temperature (T_A in °C)



Power Dissipation

Formula to Calculate the Power Dissipation in the Terminal (500 kbps)

$P_{TOT} = P_{BUS} + (P_{REL}) + P_L$

$$P_{TOT} = 0.17\ W + \sum_{i=1}^{n} (0.31\ W + I_L^2 \times 0.04\ \Omega)$$

Formula to Calculate the Power Dissipation in the Terminal (2 Mbps)

$P_{TOT} = P_{BUS} + (P_{REL}) + P_L$

$$P_{TOT} = 0.34\ W + \sum_{i=1}^{n} (0.31\ W + I_L^2 \times 0.04\ \Omega)$$

For an N/C contact, the term P_{REL} is omitted from the formula.

Where:

P_{TOT}	Total power dissipation in the terminal
P_{BUS}	Power dissipation through bus operation
P_{REL}	Power dissipation of the relay coil
P_L	Power dissipation through the load current via the contacts
n	Number of set outputs (n = 1 to 4)
i	Index
I_L	Load current of the output

Power Dissipation of the Housing Depending on the Ambient Temperature

$P_{HOU} = 2.7\ W$	$-25°C < T_A \leq +25°C$
$P_{HOU} = 2.7 - ((T_A - 25°C) \times 0.02\ W/°C)$	$+25°C < T_A \leq +55°C$

Where:

P_{HOU}	Permissible power dissipation of the housing
T_A	Ambient temperature

Safety Equipment

None

Error Messages to the Higher-Level Control or Computer System

None

Air and Creepage Distances (According to EN 50178, VDE 0109, VDE 0110)

Isolating Distance	Clearance	Creepage Distance	Test Voltage
Relay contact/bus logic	≥ 5.5 mm	≥ 5.5 mm	4 kV, 50 Hz, 1 min.
Contact/contact	≥ 3.1 mm	≥ 3.1 mm	1 kV, 50 Hz, 1 min.
Contact/PE	≥ 3.1 mm	≥ 3.1 mm	1 kV, 50 Hz, 1 min.

Approvals

For the latest approvals, please visit www.download.phoenixcontact.com.

Safety Notes for Inline Terminals Used in Areas Outside the SELV Area (AC Area)

Only qualified personnel may work on Inline terminals in the AC area.

Qualified personnel are people who, because of their education, experience and instruction, and their knowledge of relevant standards, regulations, accident prevention, and service conditions, have been authorized by those responsible for the safety of the plant to carry out any required operations, and who are able to recognize and avoid any possible dangers.
(Definitions of skilled workers according to EN 50110-1:1996).

The instructions given in this data sheet as well as the IL SYS INST UM E user manual or the Inline system manual for your bus system must be strictly observed during installation and startup.

Technical modifications reserved.

Correct Usage

The terminal is only to be used within an Inline station as specified in this data sheet as well as the IL SYS INST UM E user manual or the Inline system manual for your bus system. Phoenix Contact accepts no liability if the device is used for anything other than its designated use.

Dangerous contact voltage

Please note that there are dangerous voltages when switching circuits that do meet SELV requirements.

Only remove and insert the AC terminals when the power supply is disconnected.
When working on terminals and wiring, always switch off the supply voltage and ensure it cannot be switched on again.

Installation Instructions and Notes

Install the system according to the requirements of EN 50178.

Use grounded AC networks

Inline AC terminals must only be operated in grounded AC networks.

Read the user manual

Observe the installation instructions and notes in the IL SYS INST UM E user manual or the Inline system manual for your bus system, especially the notes on the low voltage area.

Special Features of the Terminal

The terminal can be used to switch loads up to 230 V.

Please note that the terminal interrupts the potential jumpers U_M, U_S, and GND (24 V area) or L and N (120 V/230 V areas). If required, these supply voltages must be resupplied/provided using an appropriate power terminal after the relay terminal.

Switching Loads in the 230 V Area

To switch voltages outside the SELV area, an AC area must be created corresponding to the installation instructions and notes provided in the user manual.

Operation on an AC network
Operate the terminal from a single phase on an AC network.

Switching Voltages That Are Not Available in the Segment

A relay terminal can be used to switch voltages that are not available in the segment in which the terminal is located (e.g., switching 230 V AC within a 24 V DC segment). In this case, place a distance terminal before and after the terminal (see "Ordering Data" on page 2). The isolating distances between the individual areas are thus maintained.

See also "Connection Examples" on page 10.

Local Diagnostic and Status Indicators and Terminal Point Assignment

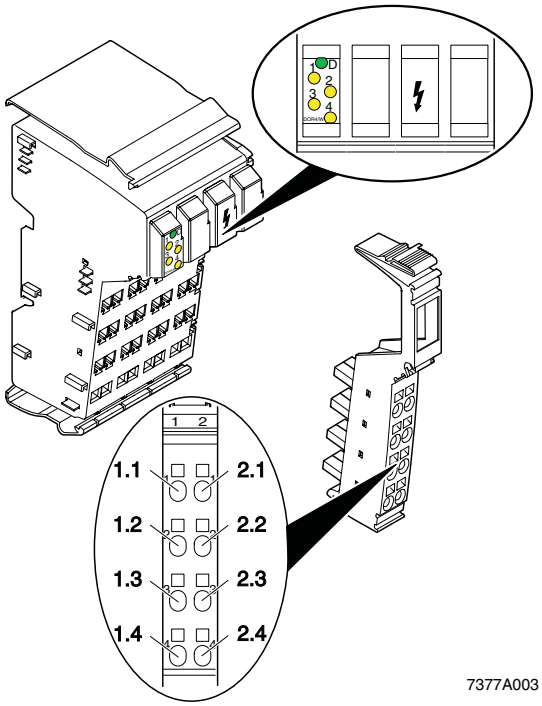


Figure 1 Terminal with one of the appropriate connectors

Local Diagnostic and Status Indicators

Des.	Color	Meaning
D	Green	Diagnostics
1, 2, 3, 4	Yellow	Output status indicator (relay has picked up)

Function Identification

Red with lightning bolt

2 Mbps: White stripe in the vicinity of the D LED

Housing/Connector Color

Dark gray housing

Dark gray connector

Terminal Point Assignment for Each Connector

Terminal Points	Assignment
1.1, 2.1	Not used (no contact present)
1.2, 2.2	Relay N/C contact
1.3, 2.3	Relay main contact
1.4, 2.4	Relay N/O contact

Adjacent contacts 1.2/2.2, 1.3/2.3, and 1.4/2.4 are jumpered in the corresponding R-IB IL SCN-8-AC-REL connector.

Internal Circuit Diagram

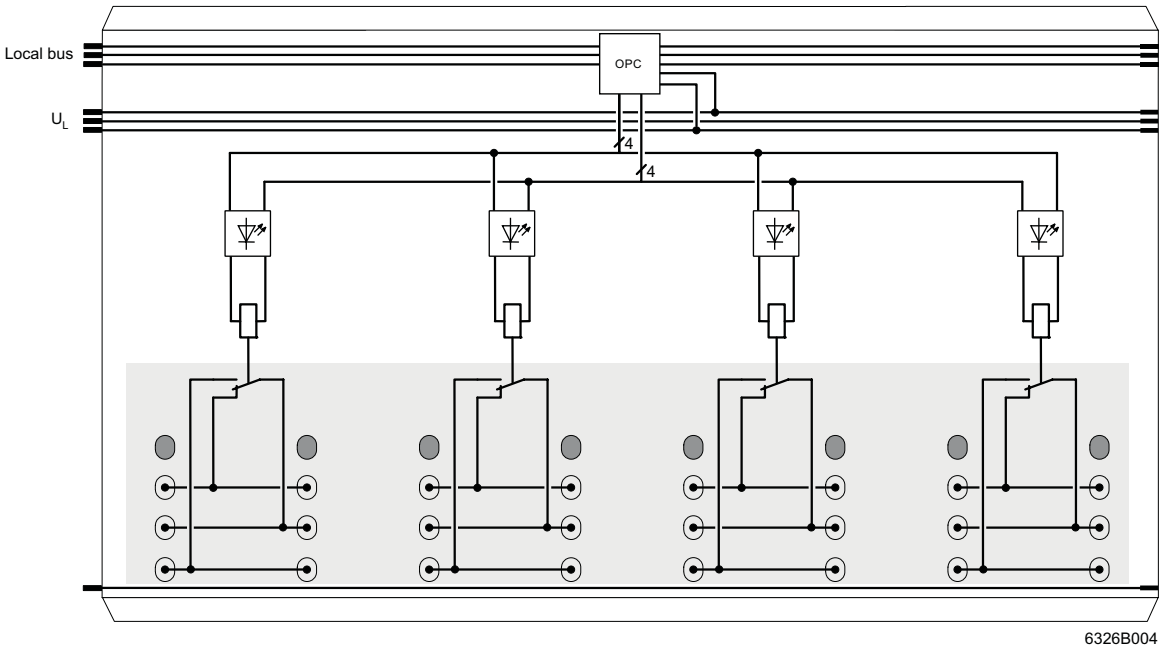


Figure 2 Internal wiring of the terminal points

Other symbols used are explained in the IL SYS INST UM E user manual or the Inline system manual for your bus system.

Key:

OPC — Protocol chip (bus logic including voltage conditioning)

LED

Terminal point, without metal contact

Relay

Electrically isolated area
I/O area including relay contact isolated from the logic area including the relay coil through "safe isolation" according to EN 50178

Connection Examples

Connecting Actuators

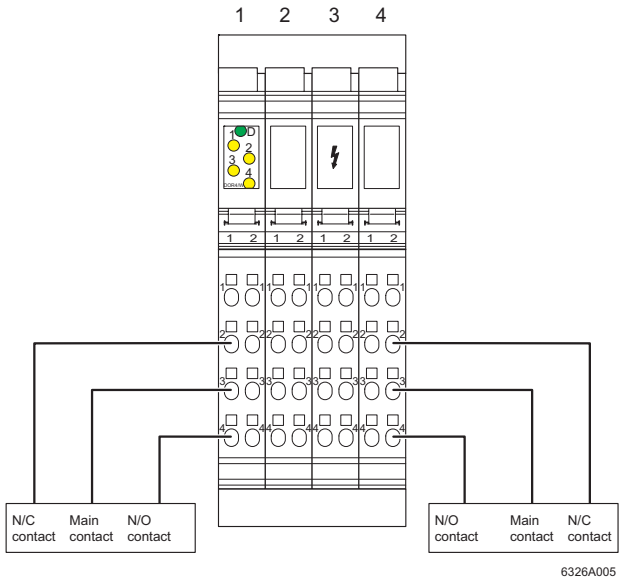


Figure 3 Typical actuator connection

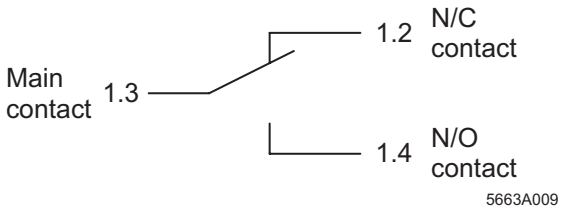


Figure 4 Output relay contacts

Switching Voltages That Are Not Available in the Segment

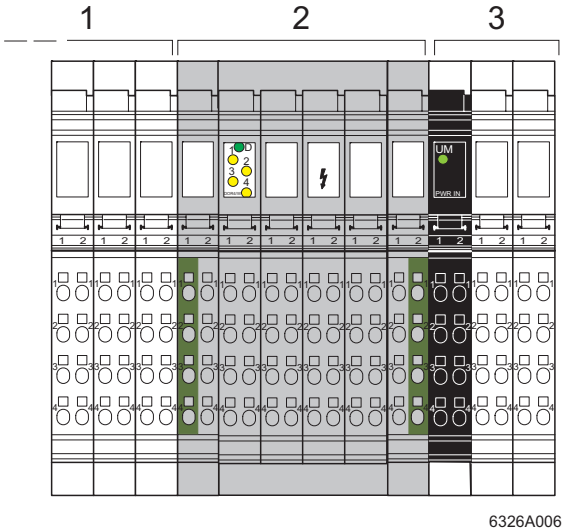


Figure 5 Example: Switching 230 V within a 24 V area

1 24 V area consisting of station head and I/O terminals

2 Terminal with four SPDT relay contacts separated from the 24 V area by Inline distance terminals

3 24 V area consisting of power terminal and I/O terminals

See also "Special Features of the Terminal" on page 7.

Also insert Inline distance terminals if you want to switch a 24 V channel within a 230 V AC area.

Switching Voltages That Are Available in the Segment

Distance terminals are not required to switch a 24 V channel within a 24 V area or to switch a 230 V channel within a 230 V area.

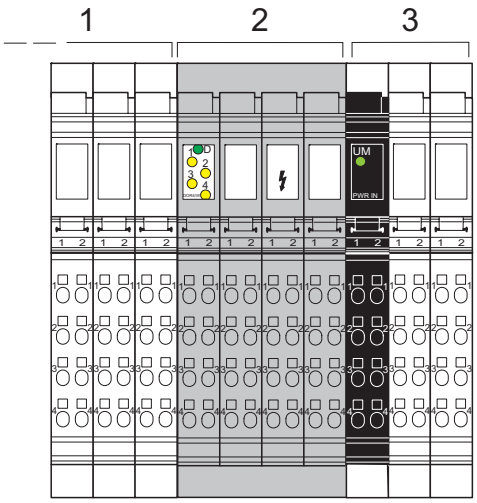


Figure 6 Switching 24 V within a 24 V area

1 24 V area consisting of station head and I/O terminals
2 Terminal with four SPDT relay contacts
3 24 V area consisting of a power terminal and I/O terminals

Interference Suppression Measures on Inductive Loads/Switching Relays

Each electrical load is a mix of ohmic, capacitive, and inductive elements. Depending on the proportion of the elements, switching these loads results in a larger or smaller load on the switch contact.

In practice, loads are generally used with a large inductive element, such as contactors, solenoid valves, motors, etc. Due to the energy stored in the coils, voltage peaks of up to a few thousand volts may occur when the system is switched off. These high voltages cause an arc on the controlling contact, which may destroy the contact through material vaporization and material migration.

This pulse, which is similar to a square wave pulse, emits electromagnetic pulses over a wide frequency range (spectral elements reaching several MHz) with a large amount of power.

To prevent such arcs from occurring, the contacts/loads must be fitted with protective circuits. In general, the following protective circuits can be used:

– Contact protective circuit
– Load protective circuit
– Combination of both protective circuits

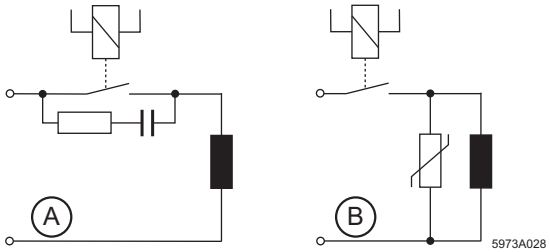


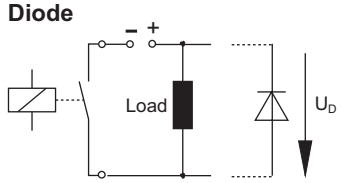
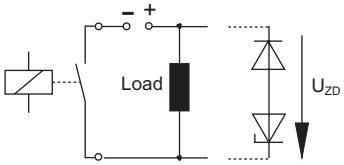
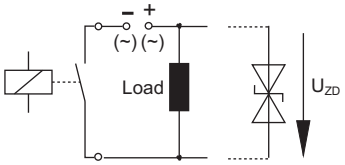
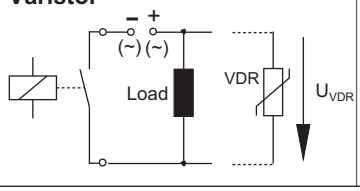
Figure 7 Contact protective circuit (A), load protective circuit (B)

If sized correctly, these circuit versions do not differ greatly in their effectiveness. In principle, safety equipment should intervene directly at the source of the interference. The following points speak in favor of a load protective circuit:

– When the contact is open, the load is electrically isolated from the operating voltage.
– It is not possible for the load to be activated or to "stick" due to undesired operating currents, e.g., from RC elements.
– Shutdown voltage peaks cannot be coupled in control lines that run in parallel.

Phoenix Contact provides protective circuit solutions in the form of terminals or electronic housing (see "CLIPLINE" or "TRABTECH" catalogs). Additional information is available on request. In addition to this, today the majority of contactor manufacturers offer diode, RC or varistor elements that can be snapped on. For solenoid valves, connectors with an integrated protective circuit can be used.

Circuit Versions

Load Wiring	Additional Drop Delay	Defined Inductive Voltage Limitation	Bipolar Attenuation	Advantages/Disadvantages
Diode 	Large	Yes (U_D)	No	Advantages: - Easy implementation - Cost-effective - Reliable - No critical sizing - Small inductive voltage Disadvantages: - Attenuation only via load resistance - Large drop delay
Series connection Diode/Zener diode 	Medium to small	Yes (U_{ZD})	No	Advantages: - Not critical sizing Disadvantages: - Attenuation only above U_{ZD}
Suppressor diode 	Medium to small	Yes (U_{ZD})	Yes	Advantages: - Cost-effective - No critical sizing - Limiting positive peaks - Suitable for AC voltage Disadvantages: - Attenuation only above U_{ZD}
Varistor 	Medium to small	Yes (U_{VDR})	Yes	Advantages: - High energy absorption - No critical sizing - Suitable for AC voltage Disadvantages: - Attenuation only above U_{VDR}

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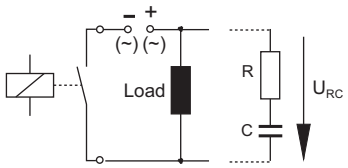
RC Circuit Versions

RC Series Circuit:

Load Wiring	Additional Drop Delay	Defined Inductive Voltage Limitation	Bipolar Attentuation	Advantages/Disadvantages
R/C combination  	Medium to small	No	Yes	Advantages: - HF attenuation due to energy absorption - Suitable for AC voltage - Level-independent attenuation - Compensating reactive current Disadvantages: - Exact sizing required - High inrush current

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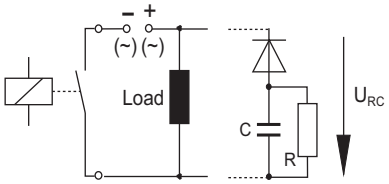
Sizing:

- Capacitor: $C \approx L_{Load}/4 \times R_{Load}^2$
- Resistor: $R \approx 0.2 \times R_{Load}$

RC Parallel Circuit With Series Diode

Load Wiring	Additional Drop Delay	Defined Inductive Voltage Limitation	Bipolar Attentuation	Advantages/Disadvantages
R/C combination with diode  	Medium to small	No	Yes	Advantages: - HF attentuation due to energy absorption - Level-independent attenuation - Current reversing not possible Disadvantages: - Exact sizing required - Only suitable for DC voltage

5663A031

Sizing:

- Capacitor: $C \approx L_{Load}/4 \times R_{Load}^2$
- Resistor: $R \approx 0.2 \times R_{Load}$

Switching AC/DC Loads

Switching Large AC Loads

When switching large AC loads, the relay can be operated up to the corresponding maximum values for the switching voltage, current, and power. The arc that occurs during shutdown depends on the current, voltage, and phase relation. This shutdown arc switches off automatically the next time the load current passes through zero.

In applications with an inductive load, an effective protective circuit must be provided, otherwise the service life of the system will be reduced considerably.

To prolong the life of the terminal as much as possible when using lamp loads or capacitive loads, the current peak must not exceed 6 A when the load is switched on.

Switching Large DC Loads

In DC operation, a relay can only switch a relatively low current compared with the maximum permissible alternating current. This maximum DC value is also highly dependent on the voltage and is determined in part by design conditions, such as the contact distance and contact opening speed.

The corresponding current and voltage values are shown using the example in Figure 8.

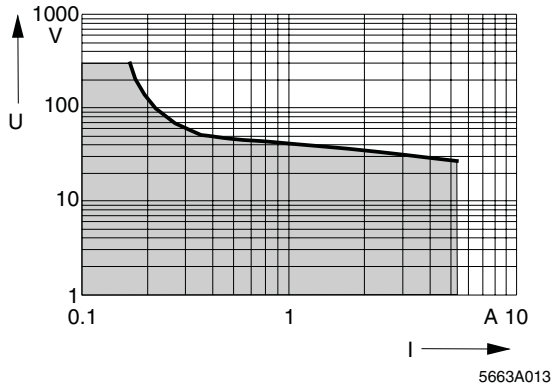


Figure 8 DC load limit curve
(REL-SNR-1XU/G 5 GOLD relay)

I Switching current in A

U Switching voltage in V

Definition of the load limit curve: For 1000 cycles, no constant arc should occur with a burning life > 10 ms.

A non-attenuated inductive load further reduces the values for switching currents given here. The energy stored in the inductance can cause an arc to occur, which forwards the current via the open contacts. Using an effective contact protection circuit, virtually the same currents can be switched as for an ohmic load and the service life of the relay contacts is the same.

If it is permitted to switch higher DC loads, several relay contacts can be switched in parallel.

The technical data for this is available on request.

Programming Data/Configuration Data

Local Bus

ID code	BD_{hex} (189_{dec})
Length code	41_{hex}
Process data channel	4 bits
Input address area	0 bits
Output address area	4 bits
Parameter channel (PCP)	0 bits
Register length (bus)	4 bits

Other Bus Systems

For the programming data/configuration data of other bus systems, please refer to the corresponding electronic device data sheet (GSD, EDS).

Process Data

Assignment of Terminal Points to OUT Process Data

(Byte.Bit) view	Bit	0.3	0.2	0.1	0.0
Assignment	Slot	4	3	2	1
	N/C contact	1.2	1.2	1.2	1.2
	Main contact	1.3	1.3	1.3	1.3
	N/O contact	1.4	1.4	1.4	1.4
Status indicator	LED	4	3	2	1

– If the bits are set to 1, the corresponding N/O contact is closed.
– The LEDs light up if the corresponding N/O contact is closed.

For the assignment of the illustrated (byte.bit) view to your INTERBUS control or computer system, please refer to the DB GB IBS SYS ADDRESS data sheet, Order No. 9000990.

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